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(56) Documents Cited
GB 2267682 A US 4450024 A

(58) Field of Search
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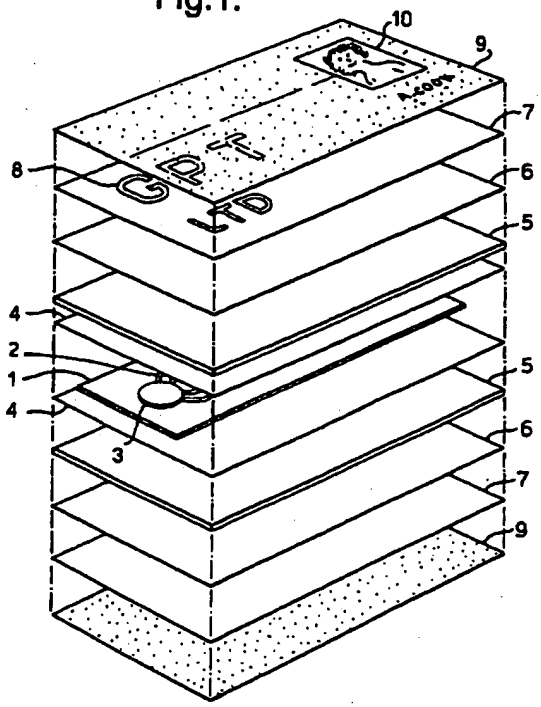
(54) **Manufacturing a smartcard**

(57) A smartcard is manufactured by providing a substrate (1), carrying electronic components (2), and which is dimensionally stable at the laminating temperature. A layer of thermoplastic material (5) dimensionally unstable at the laminating temperature is provided on either side of the substrate (1). A further layer of plastics material, e.g. polyester (8) which is dimensionally stable at the laminating temperature is provided on the outerface of each thermoplastic layer. At least one of these layers (7) is provided with an image (8). A further clear layer (9) is provided on the outside of the card and is formed from a material, such as PVC, which is capable of accepting a dye diffusion image (10). Finally the layers are heated and compressed to bond them together.

Fig.1.



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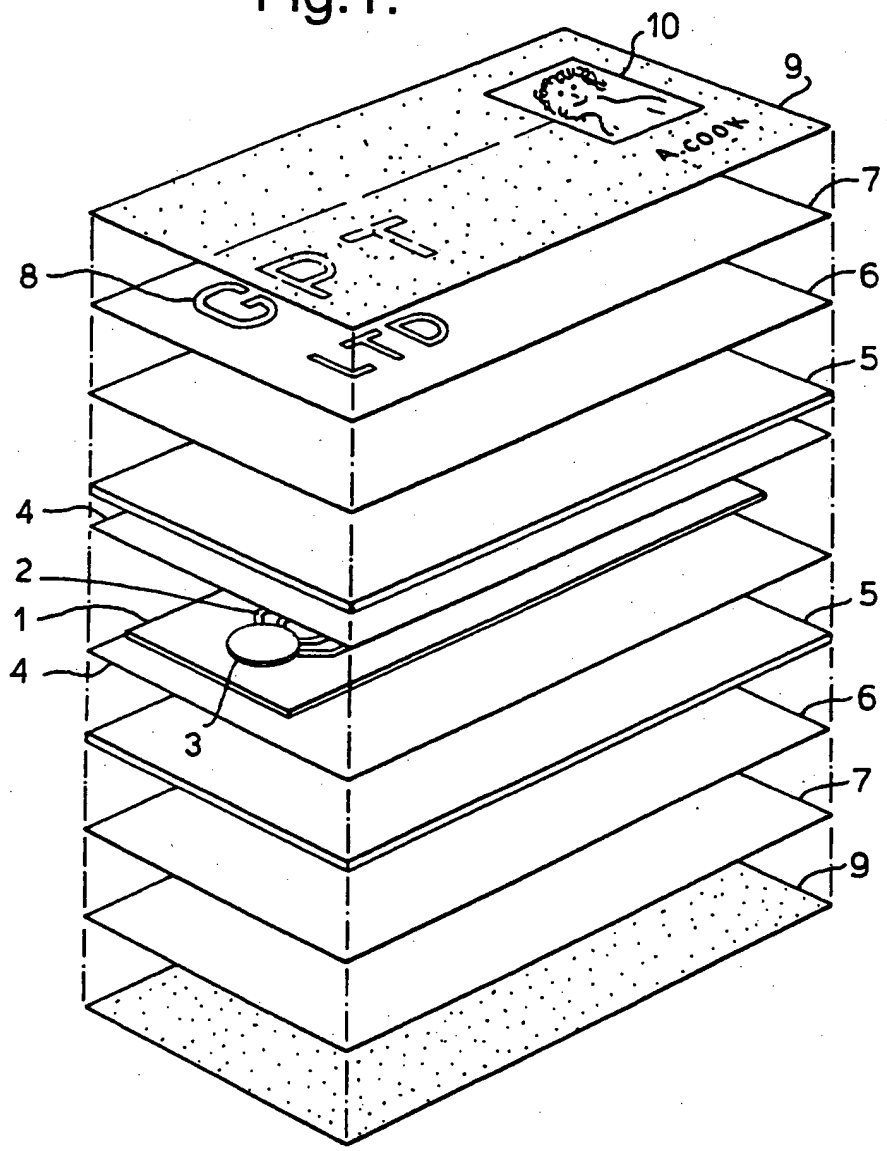
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.



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METHOD OF MANUFACTURING A SMARTCARD

This invention relates to a method of manufacturing a smartcard, or a card typically of credit card size dimensions which contains electronic components for data storage and processing, although the term as used herein is intended to encompass cards which, for example, contain only a memory and in which no actual data processing is performed.

There is frequently a requirement for a smartcard to support textual or graphic material and the need to incorporate electronic components within the card sometimes means that the outermost surface is uneven thereby leading to distortion in any printed image. There is also often a need for a card issuing authority to print customised data in addition to that already provided in the card, for example a photograph of an employee for a security card application. It is an aim of the present invention to provide a method of manufacturing such a card which can overcome both of these problems.

In a first aspect this invention provides a method of manufacturing a laminated smartcard by heating a plurality of layers to bond them together, comprising the steps of; providing a substrate, carrying electronic components, which is dimensionally stable at the laminating temperature; providing a layer of thermoplastic material dimensionally unstable at the laminating temperature on either side of the substrate; providing a layer of plastics material which is dimensionally stable at the laminating temperature and which has relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers being pre-printed with an image; providing a further clear layer on the outside of the card formed from a material capable of accepting a dye diffusion image; and heating and compressing the layers to bond them together.

It has previously been proposed to encapsulate the electronic components within a smartcard with a thermoplastically deformable material, such as PVC. Such material can provide good support for the electronic components but tends to leave an uneven surface surrounding the components which is not suitable for printing. Any printed image placed directly on the thermoplastic layer prior to heating would tend to distort when hot. The applicants have appreciated that a layer formed from a dimensionally stable high tensible material, such as polyester, will not tend to follow the movement of the thermoplastic material as it deforms around the components during lamination so that distortion of the pre-printed image is avoided. Being pre-printed, as opposed to printing directly onto the encapsulating thermoplastic layer means that should a printing error occur then only that layer need be scrapped as opposed to a complete finished card. The high tensile layers on each side of the thermoplastic layer also increase the rigidity of the card. The clear outermost layer can provide a glossy appearance to the card and also permits a card issuing authority to print an image on top of a previously formed card by a dye diffusion technique, also known as video dumping, by which a card users photograph or other customised data may be printed. Preferably the clear layer is a thermoplastic material such as PVC which can be provided with a matt finish during the heat and compression step to reduce specular reflections.

The invention also provides a heat laminated smartcard comprising a substrate carrying electronic components, a layer of thermoplastically deformable material on either side encapsulating the substrate, a layer of plastics material which is dimensionally stable at the laminating temperature and which is of relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers bearing an image, and a further clear layer on the outside of the card of a material capable of accepting a dye diffusion image.

In order that the invention may be better understood an embodiment thereof will now be described by way of example with reference to the accompanying figure which shows a perspective exploded view of a smartcard.

Referring to Figure 1 a contactless laminated smartcard comprises a substrate 1 formed from a dimensionally stable material, such as a polyester, carrying an inductive coil and associated electronic tracks 2 together with electronic components, indicated at 3 and previously "glob-topped" in known fashion with an acrylic based resin. On either side of that is provided a polyester sheet 4 which carries on each face an acrylic based adhesive incorporating a thermally activated catalyst. Such adhesives are available and have the advantage that heating to a predetermined temperature causes the catalyst to be activated and the components of the adhesive to bond rapidly. Above that there is provided a layer of thermoplastic material 5 such as PVC and a further layer of adhesive 6 of generally similar type to that in the layer 4. A layer of polyester 7, or other relatively thermally dimensionally stable material 7 is provided above the adhesive layer 6 and carries graphic material 8. On the outside surfaces of the card a layer of thermoplastically deformable material 9 is provided, such as PVC, which can receive a dye diffusion image 10 after manufacture of the card, as will be described later on.

The polyester layers will not soften or become dimensionally unstable until a temperature of about 250°C, while PVC softens and becomes fluid at about 140-150°C.

During manufacture the layers are placed between two halves of a mould (not shown) and heated to a temperature of about 150°C. The PVC layers 5 soften and flow around the components 3 on the substrate 1. The applied heat activates the catalyst in the adhesive layers

4 and 6 bonding the substrate 1 to the PVC layer 5 and the PVC layer 5 to the polyester layer 7. The polyester layer 7 being relatively more dimensionally stable and having a high tensile strength at the laminating temperature does not tend to follow the movement of the thermoplastic material and thus distortion of the image 8 is prevented. The moulding plates are adapted to provide the PVC layers 9 with a matt or slightly textured finish so as to reduce specular reflection from the finished card.

The PVC layer 9 is also suitable for accepting an image 10 using a so called video dumping technique (not shown). A thermal printhead is heated and as it passes over the card surface dyes sublimate from the printhead and diffuse into the PVC layer 9.

The card shown in Figure 1 is for a security card application in which a card, without the image 10, would be sold to a user for them to print an image, e.g., of an employee together with other customised data.

The PVC layer 9 provides a glossy finish and feel to the card and also protects the underlying graphics 8. Such an arrangement has the advantage that it would be very difficult to remove the image 10 and reprint with fraudulent data without removing the layer 9 which would tend to destroy the graphics 8. In this way the claimed arrangement can aid in providing evidence that a card has been tampered with.

Although as described the dimensionally stable layer is a polyester it is conceivable that other materials could be used instead. Similarly, the PVC layer 9 may be replaced by a pretextured material which is relatively more dimensionally stable, for example a polyester.

CLAIMS

1. A method of manufacturing a laminated smartcard by heating a plurality of layers to bond them together, comprising the steps of; providing a substrate, carrying electronic components, and which is dimensionally stable at the laminating temperature; providing a layer of thermoplastic material dimensionally unstable at the laminating temperature on either side of the substrate; providing a layer of plastics material which is dimensionally stable at the laminating temperature and which has relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers being pre-printed with an image; providing a further clear layer on the outside of the card formed from a material capable of accepting a dye diffusion image; and heating and compressing the layers to bond them together.

2. A method according to claim 1 in which the dimensionally stable layer is a polyester.

3. A method according to claim 1 or 2 in which the clear layer is a thermoplastic material dimensionally unstable at the laminating temperature and in which the outermost surface is provided with a textured finish during the heating and compression step.

4. A method according to claim 3 in which the clear layer is PVC.

5. A method according to any preceding claim in which the thermoplastic layer adjacent the substrate is PVC.

6. A method according to any preceding claim in which the heating step is carried out at

about 150°C.

7. A method according to any preceding claim in which the adhesive used to bond together one or more of the layers is an acrylic based adhesive incorporating a catalyst activated during the heating step.

8. A method according to any preceding claim in which an image is formed on the clear layer using a dye diffusion process.

9. A heat laminated smartcard comprising a substrate carrying electronic components, a layer of plastics material which is dimensionally stable at the laminating temperature and which is of relatively high tensile strength on the outer face of each thermoplastic layer, at least one of these layers bearing an image, and a further clear layer on the outside of the card of a material capable of accepting a dye diffusion image.

10. A method of manufacturing a smartcard substantially as described with reference to the drawings.

11. A smartcard substantially as described with reference to the drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Relevant Technical Fields

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(ii) Int Cl (Ed.6) B32B, G06K

Search Examiner
R J MIRAMS

Date of completion of Search
6 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI, CLAIMS

Documents considered relevant following a search in respect of Claims :-
1 to 11

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2267682 A	(GEC AVERY)	
X	US 4450024 A	(HAGHIRI-TEHRANI) eg Figures 5 and 5a	at least 1, 2,5 and 9

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).